REDESCRIPTION OF A CHINESE FRESHWATER GOBY, *GOBIUS DAVIDI* (GOBIIDAE), AND COMPARISON WITH *RHINOGOBIUS LENTIGINIS*

by

I-Shiung CHEN & Peter J. MILLER (1)

ABSTRACT. - A Chinese freshwater goby, described as *Gobius davidi* Sauvage & Dabry, 1874, has been reexamined by us. Thirty syntypes of *G. davidi* comprise two forms of gobiid, both assignable to *Rhinogobius* Gill, 1859. Twenty five specimens are identical to the types of *Rhinogobius lentiginis* (Wu & Zheng *in* Zheng and Wu, 1985). The remaining 5 specimens are now designated as lectotype and paralectotypes of *Gobius davidi* Sauvage & Dabry, being close to the original description in meristic counts and coloration. A redescription of *R. davidi* and *R. lentiginis*, and comparison between the two is presented.

RÉSUMÉ. - Redescription d'un gobie dulçaquicole de Chine, *Gobius davidi* (Gobiidae), et comparaison avec *Rhinogobius lentiginis*.

Un gobie dulçaquicole de Chine, décrit sous le nom de *Gobius davidi* Sauvage & Dabry, 1874, est réexaminé par les auteurs. Trente syntypes de *G. davidi* comprennent deux formes de Gobiidae, toutes les deux attribuables à *Rhinogobius* Gill, 1859. Vingt cinq spécimens sont identiques aux types de *Rhinogobius lentiginis* (Wu & Zheng *in* Zheng and Wu, 1985). Les 5 autres sont ici désignés comme lectotype et paralectotypes de *Gobius davidi* Sauvage & Dabry, présentant des caractères méristiques et de coloration proches de la description originale. Une redescription de *R. davidi* and *R. lentiginis*, ainsi qu'une comparaison entre ces deux *Rhinogobius* sont présentées.

Key-words. - Gobiidae, *Rhinogobius davidi*, *Rhinogobius lentiginis*, China, Redescription, Taxonomy.

A Chinese freshwater goby was described by Sauvage and Dabry (1874) as *Gobius davidi*, in honour of the collector, A. David. However, specimens have never been collected again from the type locality (Zhejiang (Tche-kiang) Prov., China) despite further surveys in this area (Zheng and Wu, 1985), although Chinese ichthyologists have attempted to characterize the species from the brief original description. In order to revise and clarify some groups of Chinese freshwater gobiids, especially *Rhinogobius* Gill, 1859, the most speciose of Asiatic freshwater gobiid genera with at least 45 species (Chen and Shao, 1996; Chen and Miller, unpubl. data), especially including 16 nominal species erroneously placed in *Ctenogobius* in mainland China (Chu and Wu, 1965; Chen, 1994), we have reexamined the syntypes of *Gobius davidi* from the MNHN to clarify the features of this possible earliest *Rhinogobius* species from China. In Japan and Taiwan, *Rhinogobius* has been reviewed in more detail and has yielded about 20 *Rhinogobius* species; those species in *R. brunneus* (Temminck & Schlegel, 1845) complex have radiated extensively into not only allopatric endemic species in isolated river basins or on islands but also including sympatric taxa (Akihito *et al. in* Nakabo 1993; Chen and Shao,

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(1) The University, School of Biological Sciences, Bristol BS8 1UG, ENGLAND.

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1996). Prior to this report, Bauchot *et al.* (1991) suggested that the syntypes of *Gobius davidi* should be assigned to the genus *Rhinogobius*. However, this material now examined by us has been found to include two distinct taxa, both *Rhinogobius* species. One is identical with *R. lentiginis* (Wu & Zheng *in* Zheng and Wu, 1985) and another, closer to the original description of *Gobius davidi*, has now been designated as forming lectotype and paralectotypes of the latter species.

MATERIALS AND METHODS

The types of *Gobius davidi* and *Ctenogobius lentiginis* are listed below. Other comparative material of the *Rhinogobius* species examined is deposited in the Biological Laboratory, Imperial Household, Tokyo, Japan (BLIH-1975172, *Rhinogobius* sp. Dark type; BLIH-1975173, *Rhinogobius* sp. Large Dark type); the Museum of Institute of Zoology, Academia Sinica (ASIZP-057219, *R. giurinus* (Rutter, 1897); ASIZP-057221, *R. candidianus* (Regan, 1908) and ASIZP-057271, *R. rubromaculatus* Lee & Chang, 1996), Taipei, Taiwan; and the Museum in Laboratory of Fishes, Shanghai Fishery University (CK), Shanghai, China for paratypes of *Ctenogobius lentiginis* Wu & Zheng *in* Zheng and Wu, 1985 listing as below.

Morphometric and meristic methods generally follow Miller (1988) except the counts of scales that follow Chen and Shao (1996). Terminology of cephalic sensory canals and free neuromast organs (sensory papillae) is from Miller (1986) and Wongrat and Miller (1991).

Meristic abbreviations. - D1, D2 first and second dorsal fins; A, anal; C, caudal; LR, longitudinal scale rows; P, pectoral; PreD, predorsal scales; SPD, scales between first dorsal fin origin and upper end of pectoral fin; TR, tranverse scale rows; V, pelvic fins; and VC, vertebral count.

Morphometric abbreviations. - Ab, anal fin base; Ad, body depth in anal fin origin; Chd, cheek depth; Cl, caudal fin length, CPd, caudal peduncle depth; CPl, caudal peduncle length; D1b, D2d first and second dorsal fin base; E, eye diameter; H, head length; Hw, head width; Iw, interorbital width; Ljaw, lower jaw length; Pl, pectoral fin length; Po, postorbital length; SN, snout length; SN-AN, distance from snout to anus; SN-A, distance from snout to anal fin orgin; SN-D1, distance from snout to first dorsal orgin; SN-D2, distance from snout to second dorsal origin; V-Ans, distance from pelvic fin origin to anus; Vd, body depth in pelvic origin and Vl, pelvic fin length.

RESULTS AND DISCUSSION

Identification of types

The syntypes of *Gobius davidi* Sauvage & Dabry, 1874 comprise 30 specimens (MNHN 6808). They show the generalised cephalic sensory system diagnostic of *Rhinogobius* (Akihito *et al.* in Masuda *et al.*, 1984; Bauchot *et al.*, 1991; Akihito *et al.* in Nakabo, 1993) as (1) row *a* and *b* below and after the anterior margin of orbit; (2) two longer horizontal rows of sensory papillae (*c* and *d*) from upper margin of upper jaw to middle or posterior half of cheek; (3) single *cp* present as in the two suggested possible types (dark and large dark types in *Rhinogobius brunneus* (Temminck & Schlegel, 1845) complex) of the type species of this genus, the Japanese Rhinogoby (Yoshinobori), *Rhinogobius similis* Gill, 1859 (suggested by Mizuno and Goto, 1987 and by Masuda *et* *al.,* 1989) and that of *Gobius davidi* as shown in figure 1. There are two distinct forms within the syntypes, quite different in coloration patterns and some meristic characters. Twenty five syntypes fit the description of *Rhinogobius lentiginis* (previously as *Ctenogobius lentiginis* Wu & Zheng, 1985). The remaining 5 specimens resemble the original description of *Gobius davidi*. Here we designate the latter 5 specimens as lectotypes and paralectotypes of *Gobius davidi*, which is the earliest published species of Chinese *Rhinogobius*, and assign the other 25 specimens to the recently described, *R. lentiginis*, after examining types of the latter from Shanghai, China.

Table I. - Morphometry of the two *Rhinogobius* species (see text for abbreviations).

	R. davidi			***R. lentiginis***	
	Lectotype	**Paralectotypes**		**Paratypes 10 out of 25 syntypes of *R. davidi***	
	MNHN 6808	**MNHN 1996 - 1330/1333**		**CK-025, 038**	**MNHN 1996-1334**
Sex	**Male**	**Male**	**Female**	**Male**	**Female**
No.	**1**	**2**	**2**	**6**	**6**
(in SL)					
H	3.14	3.21 - 3.27	3.61 - 3.66	3.08 - 3.20	3.23 - 3.50
SN-D1	2.57	2.44 - 2.51	2.55 - 2.56	2.30 - 2.56	2.44 - 2.55
SN-D2	1.67	1.66 - 1.69	1.50 - 1.74	1.54 - 1.71	1.56 - 1.75
SN-AN	1.68	1.67 - 1.71	1.58 - 1.63	1.64 - 1.73	1.56 - 1.75
SN-A	1.55	1.56 - 1.58	1.49 - 1.53	1.52 - 1.59	1.49 - 1.63
SN-V	3.15	3.00 - 3.37	3.72 - 3.73	2.99 - 3.26	3.41 - 3.60
CPd	9.04	8.66 - 8.71	8.51 - 9.00	8.91 - 9.60	8.82 - 9.86
D1b	5.52	6.08 - 6.35	5.98 - 7.03	5.47 - 6.16	5.62 - 7.96
D2b	4.72	4.64 - 5.00	5.34 - 5.48	4.66 - 5.35	4.75 - 6.30
Ab	6.68	6.30 - 7.15	6.96 - 7.80	6.03 - 6.75	6.26 - 7.98
Cl	3.57	3.46 - 3.56	3.76 - 3.88	3.61 - 4.00	3.56 - 4.30
Pl	4.74	4.65 - 4.85	4.33 - 4.49	3.81 - 4.58	3.68 - 4.97
Vl	8.58	8.08 - 8.35	6.47 - 8.12	6.16 - 7.81	5.31 - 7.20
Vd	6.55	6.30 - 6.34	5.99 - 6.61	6.10 - 7.11	5.75 - 7.80
Ad	6.61	5.79 - 6.62	5.72 - 6.49	6.75 - 8.22	5.30 - 6.73
(in HL)					
Hw	1.62	1.50 - 1.64	1.84 - 1.94	1.59 - 2.26	1.59 - 1.99
SN	3.87	3.43 - 3.81	4.07 - 4.15	2.94 - 3.83	3.63 - 4.06
E	6.30	5.34 - 6.18	4.60 - 5.70	4.85 - 5.48	4.05 - 5.19
Po	1.96	1.70 - 1.81	1.80 - 1.82	1.72 - 2.00	1.76 - 2.01
Chd	3.31	2.70 - 2.73	3.15 - 3.16	2.74 - 3.35	2.70 - 3.48
Iw (fleshy)	5.52	4.32 - 5.49	6.68 - 6.80	6.19 - 8.49	6.98 - 8.91
Iw (bony)	11.9	13.3 - 14.4	12.0 - 23.8	10.1 - 13.1	12.9 - 21.5
Ljaw	2.22	2.14 - 2.27	2.88	2.48 - 3.06	2.78 - 3.30
V-Ans/Vl	2.45	2.35 - 2.37	2.24 - 2.72	1.75 - 2.27	1.62 - 1.99
CPl/CPd	2.21	1.85 - 2.00	1.67 - 1.98	1.84 - 2.32	2.08 - 2.72

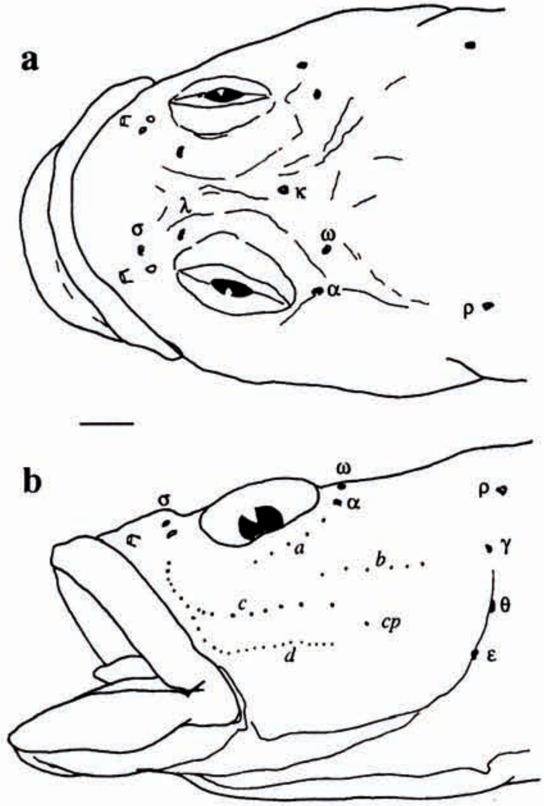

Fig. 1. - Cephalic lateral-line system of *Rhinogobius davidi* (MNHN 1996-1330). **a**: head pores in dorsal view. **b**: sensory papillae and canal pores in lateral view (opercular papillae rows abraded). Scale bar = 1 mm.

Rhinogobius davidi (Sauvage & Dabry, 1874)

Gobius davidi Sauvage & Dabry, 1874: 2 (part) (type locality: Tche-kiang (Zhejiang) Prov., China).

Material examined

Lectotype. - MNHN 6808, male, 42.2 mm SL + 11.8 mm (caudal fin length), Zhejiang Prov., coll. A. David.

Paralectotypes. - MNHN 1996-1330 to 1333, 4 spms, 2 males and 2 females, 37.7 mm SL + 11.2 mm (caudal fin length), to 41.6 mm SL + 12.0 mm (caudal fin length), Zhejiang Prov., coll. A. David (renumbered from original syntypes in MNHN 6808).

Nomenclature

The original description by Sauvage and Dabry, 1874 mentioned dorsal fin rays of « *D 6 1/9* ». This character is observed in 1 lectotype and 4 paralectotypes, the remaining specimens having 8 branched rays. Most of the other 25 syntypes have 8 branched rays as in *R. lentiginis* (Table II). The original description also noted the coloration as « pectorales noires à la base, semées de noir chez les femelles; anale portant des bandes noires », features seen in the 5 proposed lectotypes of *G. davidi*.

Description

Body cylindrical anteriorly and compressed posteriorly. Body proportions as in table I. Head somewhat depressed anteriorly, especially in male. Eyes dorsal-lateral. Interorbital (fleshy) width broader than in some congeneric species. Snout of male longer than that of female. Cheek fleshy especially in male. Mouth very oblique, about 40-50° to horizontal, especially steeper in male. Upper jaw extending to the mid-vertical of orbit in male; to the vertical of anterior margin of orbit in female. Each jaw with 3-4 rows of conical teeth, outer row largest. Tongue margin rounded. Anterior nostril a short tube and posterior nostril a round pore. VC 11+17 = 28.

Fins. - D1 VI; D2 I/9 (8-9); A I/7; P 14-16; V I/5+I/5 (Table II). Fin bases or lengths as in table I. D1 rays not elongate as filaments, reaching D2 origin in adult male, but not beyond D2 origin in female. D2 and A rear tips not extending to upper or lower origins of C; P without free rays. A origin below vertical of the second branched ray of D2. V disc rounded and somewhat smaller than among most congeneric species; both spinous rays with pointed membranous lobes. C rear edge rounded.

Scales. - Body with large ctenoid scales, LR 30-31; TR 11-12; SDP 8-10 (Table III); head, breast and the midline of belly naked; predorsal naked in both sexes. Lateral scales larger in caudal peduncle region.

Cephalic lateral line system. - Poorly preserved in lectotype. However, cheek papillae could be observed in only one male paralectotype (37.7 + 11.2 mm) although other patterns on the nape, opercle and lateral snout were lacking; all papillae and head pores are shown in detail in figure 1. The papillae pattern is typical of the *R. brunneus* complex, with a longitudinal row *a*; unlike that of the *R. giurinus* complex with several transverse rows from row *a* (Akihito *et al. in* Masuda *et al.*, 1984; Chen and Shao, 1996); and also with longitudinal row *b*, *c*, *d* and single *cp*. In head canal system, *R. davidi* is with loss of both preopercular canal (as absent of γ, δ and ε) and posterior canal above opercle (as absence of ρ, θ and τ). A pair of λ and ω absent in that which also are always seen in *R. brunneus* complex instead of a pair of papillae on their similar positions. The remain pores around eyes as double σ, α and single κ.

Coloration in preserved specimens. - Head and body uniform brown except with some irregular, small dark brown blotches and about 7 indistinct lateral dark cross-bars. Head (Figs 2, 3) with a somewhat horizontal, blackish-brown stripe above cheek forward from lower margin of eye, then abruptly vertically downward, becoming

Table II. - Frequency distribution of the number of fin rays in the *Rhinogobius* species.

	D1	D2			A	P		
	VI	I/7	I/8	I/9	I/7	14	15	16
R. davidi	5	-	1	4	5	2	2	1
R. lentiginis	12	1	10	1	12	6	6	-

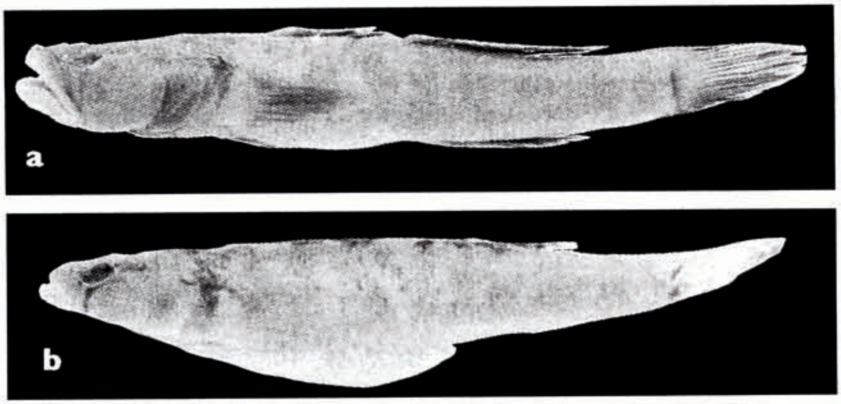

Fig. 2. - Specimen photos of *Rhinogobius davidi*. **a**: male, paralectotype (MNHN 1996- 1332); **b**: female, paralectotype (MNHN 1996-1334).

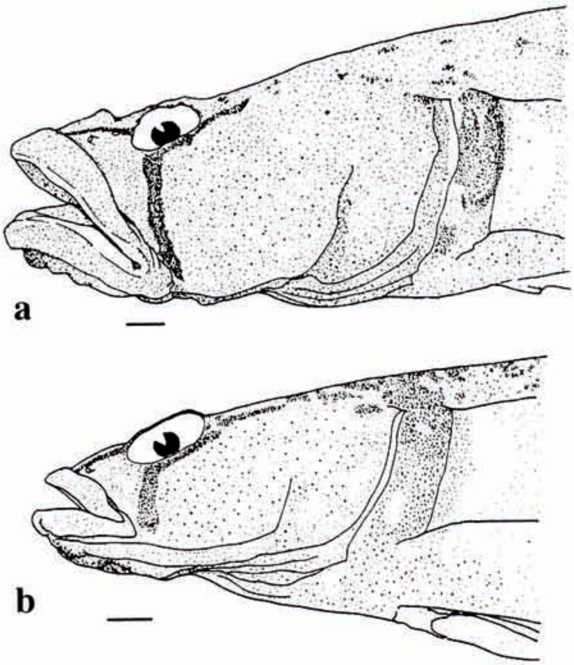

Fig. 3. - Lateral view of head and pectoral base of *R. davidi*. **a**: male, paralectotype (MNHN 1996-1332). **b**: female, paralectotype (MNHN 1996-1333). Scale bar = 1 mm.

broader below anterior pupil to the rear end of lower jaw. A pair of dark brown stripes from anterior margin of each eye extending along snout tip. Cheek and opercle without significant markings other than tiny melanophores. The branchiostegal membrane on underside blackish brown in male.

Fin coloration in male: all fins blackish brown. Basal part of D1 membrane between first and third spines with a black spot. D2, A and C membranes without distinct spots; C base with a vertical black bar; P base blackish brown, with a large semi-circularshaped pale region in its lower part. Fin coloration in female: D1 and D2 with 3-5 horizontal rows of dark spots; D1 with a black spot on the lower half of membrane in front of third spine; C with 6-8 rows of vertical brown spots (or spots connected to stripes), its base with 2 dark brown spots; P base blackish brown, a semi-circular pale region on its basal membrane.

Distribution

Rhinogobius davidi is known only from the material collected by A. David and used for the original descriptions. Additional specimens had never been found since the original report. The record (Wu *in* Chu, 1985) of *Ctenogobius davidi* from Fujian Province, China is a mis-identification (Chen and Miller, unpubl. data). This species is obviously rare or might be extinct.

Rhinogobius lentiginis (Wu & Zheng *in* Zheng and Wu, 1985)

Ctenogobius lentiginis Wu & Zheng *in* Zheng and Wu, 1985: 328 (type locality: the Ling River, Zhejiang Province, China).

Material examined

Holotype. - tt-837002, 31.5 mm SL, Tian-Tai, Ling River, Zhejiang Prov., China, but not available for examination.

Paratypes. - CK-038, 1 spm, 29.8 mm SL, male, Tsan-nan, the Ling River, Zhejiang Prov., China; CK-025, 1 spm, 29.1 mm SL, female, Tsan-nan, the Ling River, Zhejiang Prov., China.

Other material. - MNHN 1996-1334, 25 spms, Tche-kiang (Zhejiang) Prov., coll. A. David (renumbered from original syntypes in MNHN 6808).

Nomenclature

As noted above, 5 syntypes of *Gobius davidi* clearly correspond with the original description and have been designated as types of that species. The remaining 25 syntypes agree with *R. lentiginis* (Wu & Zheng), and are here discussed for comparison of the species with *R. davidi*.

Description

Morphometric characters as in table I. Head somewhat cylindrical in section. Eyes dorsal-lateral. Interorbital (fleshy) width narrow. Snout of male slightly longer than that of female. Cheek not noticeably fleshy in male. Mouth oblique, its upper jaw extending to below the anterior margin of pupil in male, and to the vertical of anterior margin of orbit in female. Otherwise as *R. davidi*. VC 10+17 = 27.

Fins. - D1 VI; D2 I/8 (rarely 7 or 9); A I/7; P 14-15; V I/5+I/5 (Table II). Fin bases or lengths as table I. D1 rays elongate beyond second D2 branched rays and higher than in adult male of *R. davidi*, but never beyond D2 origin in female. Third D1 spine longest and higher than body depth in male. D2 rear tips usually not extending to upper origins of C in adult. V disc rounded and somewhat larger than in *R. davidi*, spinous rays of each side with acute membranous lobe. C rear edge as in *R. davidi*.

Scales. - Body scales large and ctenoid, LR 30-32; TR 10; SDP 6-7. Predorsal and preanal midline naked in both sexes (Table III). Otherwise as *R. davidi*.

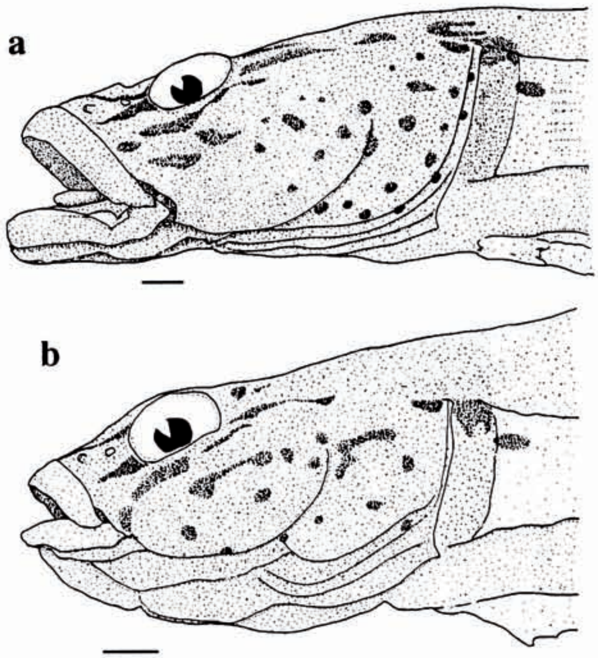

Fig. 4. - Lateral view of head and pectoral base of *R. lentiginis*. **a**: male (MNHN 1996-1334; renumbered from original syntypes of *G. davidi*). **b**: female, paratype (CK- 025). Scale bar = 1 mm.

Cephalic lateral line system. - The papillae pattern is similar to that of the *R. brunneus* complex (Akihito *et al. in* Masuda *et al.*, 1984; Chen and Shao, 1996) and even similar to *R. davidi*. However, its cephalic canals unusually degenerated and with the complete loss of all head canal pores.

Coloration. - Head and body brown or light brown. One row of large dark blotches along the lateral side of trunk, somewhat obscure in male. A distinct, discontinuous dark line on lateral midline; three narrow vertical lines on lateral belly in female. Cheek (Fig. 4) with irregular dark brown blotches; three dark lines radiating from eye to upper jaw. Several dark brown or reddish brown, round spots on cheek and opercle, shiny orange spots on the ventral branchiostegal membrane in male; but uniform dark brown spots in female. Dark brown blotches and spots on head still present, but orange spots becoming white against darker background or absent when preserved.

All fins blackish brown in male. D2 and C with 4-6 rows of dark spots in female. Basal part of D1 membrane between first and third spines with a black spot in male, indis-

Table III. - Frequency distribution of the number of scale rows in the two *Rhinogobius* species.

	LR			**TR**			**SDP**					**PreD**			
	30	31	32	10	11	12	6	7	8	9	10	0	1	2	3
R. davidi	3	2	-	-	4	1	-	-	2	2	1	5	-	-	-
R. lentiginis	3	6	3	12	-	-	5	7	-	-	-	12	-	-	-

tinct or absent in female. Horizontal oblong black spot on upper half of basal P membrane.

Distribution

This species has been found to be more widely distributed in Zhenjiang Prov. as well as at the type locality. It occurs in three main basins: the several tributaries of the Cheng-Tang River, Ling River (type locality) and O River where more collecting by one of us (I-S.C.) has yielded hundreds of specimens.

Comparison of cephalic canal pores with Japanese and Taiwanese *Rhinogobius*

In the Japanese archipelago, 9 cryptic species of the *Rhinogobius brunneus* complex are now recognized as well as one landlocked species of *R. flumineus* (Mizuno, 1960) with higher vertebral count, and another species with a transverse pattern of cheek papillae, as *R. guirinus* (Masuda *et al.*, 1989; Akihito *et al. in* Nakado, 1993; Chen and Shao, 1996). All the Japanese species retain a stable system of head canal pores comprising pores σ, λ, κ, ω, α, ρ, θ and τ from the snout via the interorbital region to above the opercle, and pores γ, δ and ε on the rear edge of the preopercle (Table IV). In contrast, these two Chinese species with higher vertebral counts: *R. davidi* has a reduced canal system and *R. lentiginis* has lost all canals. In Taiwan, most species of *Rhinogobius* are similar to the Japanese group (Chen and Shao, 1996) except a landlocked species, *R. rubromaculatus*, a western Taiwanese endemic with similar pattern to *R. davidi* (Chen and Miller, unpubl. data). This similarity in reduction of head canals may suggest that the endemic Taiwanese species *R. rubromaculatus* probably shares a common ancestor with these two sympatric Chinese species. This hypothesis of phylogeny has been treated by molecular sequences analysis (Chen and Miller, unpubl. data).

Comparison of related species in Zhejiang Province

Despite the difference in head canal system, *Rhinogobius davidi* is somewhat similar to its sympatric species, *R. lentiginis*, but the two can be distinguished by: (1) more D2 rays (always 9), TR (11-12) and SDP (8-10) in *R. davidi* than in *R. lentiginis* (Tables II, III), and more vertebae (28) in *R. davidi* than in *lentiginis*; (2) morphological features, with *R. davidi* having a smaller disc (higher value for V-Anus/Vl) in both sexes, and larger lower jaw (Ljaw) in male than *R. lentiginis* (Table I); and (3) coloration, with

Table IV. - Comparison of the patterns of head canal pores of six *Rhinogobius* species from China to Japan.

Species	**Locality**	σ	λ	κ	ω	α	ρ	θ	τ	γ	δ	ε
***R. brunneus* complex**												
Dark type	Japan	2	2	1	2	2	2	2	2	2	2	2
Large dark type	Japan	2	2	1	2	2	2	2	2	2	2	2
R. candidianus	Taiwan	2	2	1	2	2	2	2	2	2	2	2
R. rubromaculatus	Taiwan	2	0	1	0	2	0	0	0	0	0	0
R. davidi	China	2	0	1	0	2	0	0	0	0	0	0
R. lentiginis	China	0	0	0	0	0	0	0	0	0	0	0

no significant markings on cheek and opercle except the vertical dark stripe in *R. davidi*, unlike the irregular dark blotches and round spots in *R. lentiginis*.

Another *Rhinogobius*, *R. multimaculatus* (Wu & Zheng, 1985) which is endemic to the Jau River in the same province, resembles *R. davidi* in lacking median predorsal scales, but they can be separated by (1) more D2 rays (always 10) in *R. multimaculatus* than in *R. davidi*; (2) more LR (33-35) in *R. multimaculatus* than in *R. davidi*; and (3) coloration, with many quite minute dark spots scattered on cheek, opercle and even most lateral scales of body in *R. multimaculatus*, but none on head and body in *R. davidi*.

So far, this group contains not only the 3 nominal species mentioned in this paper but also some undescribed species in Zhejaing province where more *Rhinogobius* specimens have been collected recently by one of us (I-S.C.). A detailed revision is in progress (Chen and Miller, unpubl. data).

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